

# Association Between Pediatric Inpatient Rehabilitation Services and Children's Functional Outcomes: King Fahad Medical City Experience

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## ABSTRACT

**BACKGROUND:** Disability may affect children's performance of functional activities. This may translate to difficulties in returning to home and/or school. It has been documented that intensive rehabilitation programs for children with disabilities lead to an improvement in their functional abilities. Wee-FIM is a valid and reliable outcome measure that is used commonly with children undergoing rehabilitation.

**OBJECTIVES:** To study changes in the functional status of children admitted to a specialized pediatric inpatient rehabilitation unit.

**DESIGN:** A retrospective cohort study.

**SETTING:** King Fahad Medical City—Rehabilitation Hospital, Riyadh, Saudi Arabia.

**METHODS:** Investigators reviewed records of children admitted to a pediatric rehabilitation unit between January 1, 2012, and December 31, 2017. The outcome measures used were rehabilitation length of stay (LOS), Wee-FIM gain, and Wee-FIM efficiency.

**RESULTS:** The total number of records included in this study was 361 records. Sixty percent of the children were boys. The mean age was  $8.7 \pm 3.8$  years (range, 3–17 years). Children with cerebral palsy accounted for 45.2% of the children. The mean LOS was 43 days. Children with brain tumors had the shortest LOS compared with children with other diagnoses. Mean (SD) Wee-FIM efficiency was 0.58 ( $\pm 0.6$ ). Highest Wee-FIM efficiency was observed in children with brain tumors. Average Wee-FIM gain was 20 ( $\pm 15$ ). The highest functional gain was 27 in children with brain tumors while the lowest was 16 in children with cerebral palsy.

**CONCLUSIONS:** Intensive inpatient rehabilitation program is associated with improvement in functional performance in children with a variety of impairments and disabilities.

**KEYWORDS:** Pediatric rehabilitation, outcomes, Wee-FIM

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## Introduction

In 2016, the number of Saudis with a disability was reported to be 667 280 persons. Of those, 209 574 were less than 19 years of age.<sup>1</sup> Children with a disability may experience changes in their performance of activities of daily living such as eating, bathing, dressing, mobility, and so on; cognitive abilities; and behaviors.<sup>2,3</sup> These changes can have a significant impact on child's participation at home and community.<sup>3</sup> Some children with central nervous system diseases such as traumatic brain injury (TBI), spinal cord injury (SCI), and cerebral palsy may be referred to specialized rehabilitation centers for intensive inpatient rehabilitation program to restore or maximize functions; improve quality of life; enable return to home, school, and community; minimize the impact of long-term disability; and provide support for families.<sup>4,5</sup> One place where pediatric rehabilitation programs can take place is inpatient settings. There are 3 types of facilities where this can take place: (1) rehabilitation units within children specialized hospital, (2) designated pediatric rehabilitation unit within a free-standing rehabilitation hospital, and (3)

designated pediatric rehabilitation beds within a large rehabilitation unit that is a part of a comprehensive medical complex.<sup>4,6,7</sup> In rehabilitation, children receive a minimum of 3 hours per day of therapeutic interventions. Therapeutic interventions may include physical, occupational, and speech therapy. Additional services may be provided based on the child's needs such as prosthetics and orthotics and recreational and art therapy. Such care requires a multidisciplinary approach, where a team of specialists works together with the child and the family to achieve a common goal.<sup>8</sup>

Within pediatric rehabilitation literature, there is evidence that receiving inpatient rehabilitation is associated with improved functional outcomes even among children with severe disabilities.<sup>2,9–17</sup> A recent analysis of 10 141 children with TBI has found a large effect on motor and cognitive functional scores post inpatient rehabilitation.<sup>9</sup> Garcia et al<sup>18</sup> reported significant gains in the functional status of 91 children with SCI who received rehabilitation. In addition, Fuentes et al<sup>12</sup> compared functional outcomes between children receiving inpatient rehabilitation at children's hospitals and those at



other facilities and found children who received inpatient rehabilitation at children's hospitals had more efficient inpatient rehabilitation admissions with shorter lengths of stay and slightly better cognitive function at discharge than did children at other type of facilities.

### Importance of Using Outcome Measures

The use of standardized outcome measures in inpatient rehabilitation settings is essential to determine the changes in health and functional status between initial assessment and a later assessment, to develop treatment goals, and to formulate discharge plans. They provide valuable information to the treating team and patients and their families.<sup>19</sup> They also give the rehabilitation program the chance to assess their efficacy and compare their results with other programs.<sup>3,20</sup> Functional Independence Measure for Children (Wee-FIM) is one of the most common outcome measures used with children; it was developed in 1987 to measure the severity of disability in children older than 6 months.<sup>21</sup> Wee-FIM is used with children aged 6 months to 7 years and older.<sup>22</sup> It can also be used for children over the age of 7 with functional disabilities to provide information about the child's performance in some basic activities in a simple day-to-day language.<sup>13</sup>

Wee-FIM measures the child usual performance in 6 domains of self-care, sphincter control, transfer, locomotion, communication, and social cognition. Each domain contains different tasks (Table 1 presents Wee-FIM domains).

It is scored on a 7-level ordinal scale ranging from 7 (complete independence) to 1 (total assistance). A child's performance is measured by taking into account the amount of assistance needed from a helper or the use of an assistive device. The need for assistance can be translated into the burden of care or the time and energy the helper needs to exert to serve the child performing a specific task. A score from 1 to 4 indicates that the child needs assistance (total, maximum, moderate, or minimal) to perform the activity. A score of 5 indicates that the child needs supervision, cuing, or setup assistance to perform the activity. A score of 6 means that the child can complete the activity independently, but may need an assistive device, more than a reasonable amount of time, or safety is a concern. A score of 7 means that the child performs the activity independently.<sup>21</sup> All items must be rated. A score of "zero" or "non-applicable" cannot be given. The lowest possible total score is 18 (means that the child requires total assistance in all tasks) while the maximum possible total score is 126 (means that the child is independent in all tasks).<sup>13</sup>

One of the key features of Wee-FIM that makes it popular in rehabilitation facilities that it is a discipline-free measure that can be used by any trained health care professionals, regardless of their discipline. However, some professionals may have difficulties assessing some activities. In such cases, another professional can participate in the Wee-FIM assessment. The 18 items can be divided among different rehabilitation

**Table 1.** Wee-FIM domains.

Self-care
Eating
Grooming
Bathing
Upper-body dressing
Lower-body dressing
Toileting
Sphincter control
Bladder management
Bowel management
Transfer
Transfer to chair or wheelchair
Transfer to toilet
Transfer to tub or shower
Locomotion
Walking, wheelchair, or crawling
Stairs
Communication
Comprehension
Expression
Social cognition
Social interaction
Problem solving
Memory

Abbreviation: Wee-FIM, Functional Independence Measure for Children.

professions based on their expertise and scope of practice.<sup>21</sup> The Wee-FIM has been proven to be valid, reliable, and sensitive for children with a variety of developmental and neurodevelopmental disabilities.<sup>13,23-25</sup>

Functional gains post-rehabilitation is a strong indicator of the success of the rehabilitation program. Therefore, information about the recovery pattern and the expected amount of functional gain should be reported. To the researchers' knowledge, there are limited studies that addressed the functional gains of children after intensive rehabilitation in Saudi Arabia. More specifically, this study addressed the following questions:

1. What is the overall pattern of functional status at admission and discharge between multiple FIM domains (self-care, sphincter control, mobility, and communication and social cognition) during inpatient rehabilitation?

2. Do children show a significant change within each domain?
3. Is there a significant relationship between age and diagnosis to the amount of functional change during inpatient rehabilitation?

## Method and Methodology

### Study design

This retrospective cohort study was conducted at King Fahad Medical City (KFMC)—Rehabilitation Hospital located in Riyadh, Saudi Arabia. It included all children and adolescents who received inpatient rehabilitation between January 1, 2012, and December 31, 2017, at pediatric inpatient rehabilitation unit. Records of patients admitted to the pediatric rehabilitation unit at that period were reviewed electronically by investigators. All information, such as age, gender, diagnosis, onset of injury to admission, length of stay (LOS), Wee-FIM admission scores, and Wee-FIM discharge scores, were manually extracted to a data collection sheet.

### Participants

#### Inclusion criteria

- Children and adolescents admitted to the rehabilitation hospital from January 2012 till June 2017;
- Age from 3 to 17 years.

#### Exclusion criteria

- Children younger than 3 years or older than 17 years;
- Records with LOS of 7 days or less as they indicated short stays for evaluation;
- Incomplete records.

### Main outcome measures

Rehabilitation LOS, Wee-FIM gain, and Wee-FIM efficiency were the outcome measures used for this study. Rehabilitation LOS was calculated as the total number of rehabilitation days from admission to the unit to discharge. Wee-FIM gain is calculated as the difference in Wee-FIM scores between admission and discharge. Wee-FIM efficiency is calculated as total Wee-FIM gain divided by net LOS.

### Data analyses

Descriptive statistics (means, standard deviations, range, and frequencies) were performed for patient demographics, time to rehabilitation, LOS, and Wee-FIM scores. Multivariate analysis of variance (MANOVA) was used to compare the mean gains in self-care, sphincter control, mobility (transfer and locomotion), and cognition (communication and social cognition) across impairment groups (diagnosis), with age, LOS, and total Wee-FIM admission.<sup>26</sup>

**Table 2.** Demographics.

CHARACTERISTIC	DESCRIPTION	
Gender	Male	219 (60.7%)
	Female	142 (39.3%)
Age (y)	≤7	147 (40.7%)
	>7	214 (59.3%)
LOS	≤4 weeks	91 (25.2%)
	>4 weeks	270 (74.8%)

Abbreviation: LOS, length of stay.

Children were classified into 2 groups: younger than 7 years of age (<7) and 7 years of age or older (≥7) because the Wee-FIM is normed up to 7 years of age.

A paired *t* test was used to evaluate differences in Wee-FIM scores from admission to discharge. Analyses of mean changes (functional improvement) were used to assess treatment effectiveness across the cohorts.

## Results

This retrospective chart review included 361 children. Boys constituted 60.7% of the study cohort. The mean age was  $8.7 \pm 3.8$  years (range, 3–17 years). A total of 214 children (59.3%) were older than 7 years of age at admission. Children's demographics are summarized in Table 2.

### Impairment groups

Four impairment groups were represented in the sample as obtained from the medical records. Overall, cerebral palsy (CP) accounted for the largest proportion of children (N=163, 45.2%), followed by acquired brain injury (ABI) (N=84, 23.3%), others (N=44, 12.1%), spinal cord injury (SCI) (N=35, 9.7%), and brain tumor (BT) (N=35, 9.7%). "Others" was used to capture children with a variety of impairments such as Gillian-Barre Syndrome, amputation, and congenital limb deficiency.

### LOS and onset to admission

The mean (SD) LOS was 43 ( $\pm 24$ ) days. Children with BT stayed shorter with mean (SD) 38 ( $\pm 16$ ) days. The average time from injury to rehabilitation admission was 1524 ( $\pm 1545$ ) days. The longest onset was with children diagnosed with CP with 2753 ( $\pm 1161$ ) days, while the shortest onset was with BT children with mean (SD) 185 (412) days.

### Wee-FIM efficiency

Mean (SD) Wee-FIM efficiency for children after intensive rehabilitation was 0.58 ( $\pm 0.6$ ). Children with BT had more efficient rehabilitation among other children, with a mean

**Table 3.** Wee-FIM change by impairment group.

IMPAIRMENT	CP (N=163)	BT (N=35)	ABI (N=84)	SCI (N=35)	OTHERS (N=44)	TOTAL (N=361)
	MEAN (SD) MIN-MAX					
Age (y)	8 (3) 3-16	9 (3) 4-16	9 (4) 3-17	11 (5) 4-17	10 (4) 4-17	9 (4) 3-17
LOS (days)	39 (18) 8-118	38 (16) 8-77	48 (30) 8-135	49 (28) 8-143	43 (28) 13-186	43 (24) 8-186
Onset days	2753 (1161) 1061-5812	185 (412) 3-2273	545 (891) 5-5283	289 (494) 4-1804	888 (1525) 4-5659	1524 (1545) 3-5812
Efficiency	0.44 (0.41)	0.9 (1.1)	0.64 (0.61)	0.55 (0.5)	0.8 (0.7)	0.58 (0.6)

Abbreviations: ABI, acquired brain injury; BT, brain tumor; CP, cerebral palsy; LOS, length of stay; SCI, spinal cord injury.

efficiency of 0.9 ( $\pm 1.1$ ). Tables 3 and 4 show the descriptive statistics by impairment group (diagnoses). Wee-FIM score are detailed in Table 4.

### Functional Gains During Rehabilitation

The mean admission total Wee-FIM score was 58 ( $\pm 24$ ) and the mean discharge total Wee-FIM score was 78.6 ( $\pm 28$ ). Between admission and discharge, children made an average gain of 20 ( $\pm 15$ ). This overall improvement was seen more notably in children with BT and children with other diagnoses with 27 (17) and 26 (17) respectively; however, the least functional gain was observed in children with CP 16 ( $\pm 11$ ). Large standard deviations indicate there were large variations among children in terms of their functional improvement.

A small percentage of the children, 5.5% (N=20), did not show gain in Wee-FIM at the time of discharge. Sixty percent of them (N=12) were children with CP and none were children with BTs.

When looking at the Wee-FIM domains, 169 children (46.8%) did not show any improvement in sphincter control items (84 CP, 38 ABI, 18 others, 17 SCI, and 12 BT). Number of children who showed no gain in self-care items was 68 children (18.8%) (32 CP, 14 ABI, 9 SCI, 9 others, and 4 BT). In total, 158 children (43.7%) had no functional gain in cognition (communication and social cognition) domain (83 CP, 33 others, 27 ABI, and 15 BT). However, all children with SCI were excluded, as they did not have any cognitive impairment at the time of admission. A total of 67 children (18.5%) had no functional gain in mobility (transfer and locomotion) domain (35 CP, 19 ABI, 6 others, 5 BT, and 2 SCI).

One-way MANOVA revealed a significant multivariate main effect for Impairments based on a Four Wee-FIM scores,  $F(16, 1079) = 4.46$ ,  $P < .0005$ ; Wilks'  $\lambda = 0.882$ , partial eta squared;  $\eta^2 = .048$  and power to detect the effect was

1.000. This confirms that there was a statistically significant difference for Impairments based on the Gain in Four Wee-FIM Scores (Self-care, Sphincter Control, Mobility, and Cognition).

In addition, the significant univariate main effects of Impairment was obtained on Gain in Self-care Wee-FIM Score,  $F(4, 356) = 8.93$ ,  $P < .0005$ , partial  $\eta^2 = .09$ ; Gain in Mobility Wee-FIM Score,  $F(4, 356) = 6.77$ ,  $P < .0005$ , partial  $\eta^2 = .07$ ; and Gain in Cognition Wee-FIM Score,  $F(4, 356) = 5.91$ ,  $P < .0005$ , partial  $\eta^2 = .06$ . However, least contribution in recovery from Impairment was observed across Gain in sphincter control,  $F(4, 356) = 0.95$ ,  $P = .434 (>.01)$ , partial  $\eta^2 = .01$ .

Regression analyses were performed to examine functional domain gain controlling for age ( $1 \geq 7$  years of age,  $0 < 7$ ), diagnosis, and admission functional status. The results indicated that children improved more in self-care and mobility if they were 7 years of age or older, had lower self-care and mobility scores at admission, and diagnosed with ABI or BT. The regression analyses of self-care, sphincter control, mobility, and cognitive gain; the variance (adjusted  $R^2$ s); the standardized coefficients ( $\beta$  represents the relative contribution of each independent variable when all other variables are controlled for); and the F statistics are summarized in Table 5.

### Discussion

This study provides important data on functional outcomes after comprehensive, interdisciplinary inpatient rehabilitation of children with a wide range of disabilities in Saudi Arabia. This potentially allows us to compare functional differences between diagnoses and age. More importantly, these data confirm that inpatient rehabilitation programs improve functional outcomes across a wide range of diagnoses.

This study revealed that CP had the highest incidence which was consistent with the findings of Al Salloum et al,<sup>27</sup> which showed that CP was the most common neurologic

**Table 4.** Descriptive statistics by impairment group.

IMPAIRMENT						
	CP	BT	ABI	SCI	OTHERS	TOTAL
<b>RAW WEE-FIM SCORES<sup>a</sup></b>						
MEAN (SD)						
Admission	54 (23)	61 (21)	55 (28)	70 (19)	68 (26)	58 (25)
	18-116	19-104	18-117	43-115	21-122	18-122
Discharge	70 (27)	89 (26)	77 (31)	93 (19)	94 (25)	79 (28)
	18-125	22-122	18-126	66-123	40-124	18-126
Gain	16 (11)	27 (17)	23 (17)	23 (17)	26 (17)	20 (15)
	0-58	1-69	0-78	0-64	0-66	0-78
Efficiency	0.44 (0.41)	0.9 (1.1)	0.64 (0.61)	0.55 (0.5)	0.8 (0.7)	0.58 (0.6)
<b>RASCH-TRANSFORMED MEASURES<sup>b</sup></b>						
MEAN (SD)						
Self-care admission	14 (9)	13 (6)	14 (10)	20 (10)	19 (12)	15 (10)
	6-42	6-27	6-42	7-42	6-42	6-42
Self-care discharge	20 (10)	26 (11)	23 (12)	30 (9)	30 (11)	23 (11)
	6-42	6-42	6-42	12-42	6-42	6-42
Self-care gain	6 (5)	13 (9)	9 (8)	10 (9)	11 (10)	9 (8)
	0-27	0-30	0-36	0-30	0-35	0-36
Mobility admission	11 (7)	16 (9)	13 (9)	12 (8)	14 (8)	12 (8)
	5-35	5-34	5-35	5-31	4-32	4-35
Mobility discharge	17 (9)	24 (9)	20 (10)	22 (8)	24 (9)	20 (10)
	5-35	5-35	5-35	7-35	5-35	5-35
Mobility gain	6 (6)	9 (7)	8 (7)	10 (7)	11 (8)	8 (7)
	0-26	0-25	0-26	0-27	0-31	0-31
Cognition admission	25 (11)	27 (9)	23 (10)		30 (9)	26 (10)
	5-35	5-35	5-35		5-35	5-35
Cognition discharge	27 (10)	31 (7)	26 (9)		32 (6)	28 (9)
	5-35	8-35	5-35		8-35	5-35
Cognition gain	2 (3)	4 (6)	4 (4)		2 (5)	2 (4)
	0-26	0-30	0-15		0-17	0-30
Sphincter control admission	5 (3)	6 (3)	5 (4)	5 (3)	6 (4)	5 (3)
	2-12	2-12	2-14	2-12	2-14	2-14
Sphincter control discharge	6 (4)	8 (4)	7 (4)	6 (4)	8 (4)	7 (4)
	2-14	2-14	2-14	2-14	2-14	2-14
Sphincter control gain	2 (2)	2 (2)	2 (3)	2 (3)	2 (2)	2 (2)
	0-12	0-6	0-10	0-10	0-6	0-12

Abbreviations: ABI, acquired brain injury; BT, brain tumor; CP, cerebral palsy; SCI, spinal cord injury; Others, other impairments.

<sup>a</sup>Wee-FIM=Functional Independence Measure for Children (UDSMR, 1993).

<sup>b</sup>Interquartile range of onset (time from diagnosis of impairment to rehabilitation admission).

**Table 5.** Prediction of gain in self-care, sphincter control, mobility, and cognition.

INDEPENDENT VARIABLES	GAIN IN SELF-CARE	GAIN IN SPHINCTER CONTROL	GAIN IN MOBILITY	GAIN IN COGNITION
	$\beta^a$			
Domain function status of admission <sup>b</sup>	-0.31	-0.15	-0.26	-0.5
Age <sup>c</sup>	0.21	0.19	0.14	-0.03
Diagnosis <sup>d</sup>	0.24	0.03	0.24	0.1
Adjusted $R^2$	0.15	0.03	0.13	0.24
F	21.38	5.22	19.46	39.52
df	360	360	360	360

Abbreviations: ABI, acquired brain injury; CP, cerebral palsy; MANOVA, multivariate analysis of variance; SCI, spinal cord injury.

Bonferroni correction in this MANOVA is set for statistical significance at  $P < .01$ .

<sup>a</sup>Standardized coefficient  $\beta$ s are reported, all significant at  $P < .05$ .

<sup>b</sup>Admission self-care is used to predict Gain in Self-Care, admission mobility is used to predict Gain in Mobility, and admission cognition is used to predict Gain in Cognition.

<sup>c</sup>Dummy variable, 2="7 years of age or older," 1="under 7 years of age."

<sup>d</sup>Dummy variable, "1=CP, 2=brain tumor, 3=ABI, 4=SCI, and 5=Other impairments."

disorder among Saudi children with a prevalence rate of 2.34 per 1000. It is also supported by a study conducted in Nigeria which showed that CP was accounted (43.7%) for the majority of the cases visiting the physical therapy department.<sup>28</sup>

In general, through an interdisciplinary inpatient rehabilitation approach, children made significant changes from admission to discharge, which is supported by the previous studies that reported an overall change in outcomes after rehabilitation.<sup>2,5,14,17,18,29-31</sup> Functional gains, as measured by the Wee-FIM instrument, vary depending on diagnoses, time from injury/diagnosis to rehabilitation admission, age, and LOS. The results of this study showed significant differences in gains across age and impairment groups, children older than 7 years made larger gains than younger children. Because older children may already have learned the functional skills prior to their injuries, they showed a higher functional gain in contrast to children with CP who may have not learned so many functional skills prior to their diagnoses. This is consistent with the findings of the previous study by Chen et al,<sup>17</sup> evaluating the impact of pediatric rehabilitation services on children's functional outcomes. They reported that children older than 7 years and those with a traumatic injury (such as ABI) made larger gains than younger children with a non-traumatic injury. Our findings were also consistent with previous studies by Rice et al<sup>14</sup> and Jimenez et al,<sup>9</sup> which reported a positive correlation between age and Wee-FIM scores for children with TBI. Conversely, Garcia et al<sup>18</sup> and McAuliffe et al<sup>32</sup> reported no correlation between age and functional gains in children with CP<sup>32</sup> and SCI.<sup>18</sup>

Children with ABI and BTs showed a significant difference in functional outcome. The primary explanation for this difference (greater Wee-FIM gains in ABI and BTs) is that these patients may have been admitted earlier than other groups, thus giving them earlier access to rehabilitation, which in turn

translates into functional gains. This is consistent with existing literature which reported that early rehabilitation admission was associated with higher discharge Wee-FIM scores<sup>29</sup> while children with late admission to rehabilitation had poorer functional outcome at discharge.<sup>10</sup> Another explanation would be that children in the ABI/BTs group generally did not have impairments prior to their injury/diagnosis but were hospitalized in a specialized rehabilitation unit because of functional limitations enough to prevent them from returning home. In addition, this finding is consistent with existing literature demonstrating that low functional gain at discharge was correlated with a number of comorbid medical and physical conditions, with mental disorders.<sup>5</sup> The smaller functional gain in the CP group may be related to the onset, because these children were admitted between 2 and 16 years of age, thus they may have less potential to improve. Moreover, children with CP in this cohort had more comorbidities, longer onset, and lower functionality at discharge than other groups.

When comparing overall differences in gains made across the domains of self-care, mobility (transfer and locomotion), cognition (communication and social cognition), and sphincter control, our data showed that there were greater gains in self-care and mobility domains which is consistent with previous studies. Chen et al<sup>33</sup> reported improvement in self-care and mobility domains in children who received more occupational therapy and physical therapy, respectively. Similarly, Garcia et al<sup>18</sup> and Allen et al<sup>34</sup> reported improvement in motor functions in children with SCI post-intensive rehabilitation.

The minimum gains seen in Wee-FIM were in sphincter control and cognition items. This may be related to differences in the impairment groups in this study as well as the high percentage of patients with CP. The high percentage of CP children could account for a trend toward lower gains in cognition and sphincter control.

Children in our study had longer onset to rehabilitation admission than that of other countries.<sup>17</sup> This is consistent with other studies conducted in Saudi Arabia with adults with TBI<sup>35</sup> and SCI.<sup>36</sup> This can be attributed to the limited number of rehabilitation facilities in Saudi Arabia, which might make it difficult to admit patients immediately after their diagnosis or injury from acute care settings. It is also observed that this study had large number of children with CP. Although it is unusual for such population to be admitted to inpatient rehabilitation units, those children were admitted to our facility because admission to our facility is governed by functional limitations not by diagnosis.

Differences in LOS, however, were not significant among impairment groups. Generally, children with ABI and SCI stayed longer. This is consistent with the findings of previous studies evaluating functional outcomes in children with SCI,<sup>18</sup> which showed that Wee-FIM gain was not significantly related to the length of inpatient rehabilitation. The lack of correlation between Wee-FIM gain and LOS found in this study suggests that a variety of other neurologic, developmental, medical, familial, and social factors affect Wee-FIM gain and LOS.<sup>37</sup>

### Limitations

It is important to consider the potential limitations to this study; one major limitation in this study is inclusion bias. This study is limited to children who received inpatient rehabilitation at KFMC; therefore, our population in this study does not necessarily reflect the wide range of children who need inpatient rehabilitation and may not be representative of the patients seen at other inpatient rehabilitation hospitals or units.

### Conclusions and Recommendation

This study provides some initial description of functional gain after intensive inpatient rehabilitation in a fairly large and diverse group of children with different impairments. Although this makes a good basis for comparison for clinicians and researchers interested in the expected functional outcomes post-intensive rehabilitation, further research might be needed to examine the effect of specific interventions to focus on changes in particular skills.

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### Author Contributions

All authors contributed to the collection of data, analysis and writing of the manuscript.

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